

--	--	--	--	--	--	--	--	--	--

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2021/2022 SESSION

PPS0016 – INTRODUCTION TO PROBABILITY AND STATISTICS

(All sections / Groups)

7 OCTOBER 2022
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 5 pages (excluding the cover page) with 5 questions.
2. Answer all questions.
3. Unless stated otherwise, if an answer is given as a decimal, it should be rounded to four significant figures.
4. Write your answers in the Answer Booklet provided.
5. Show all relevant steps to obtain maximum marks.

Question 1 [20 marks]

The following data give the patients' waiting time (in minutes) from registration to seeing the doctor in a clinic.

48	58	37	44	32	24	48	31	51	45
42	25	35	18	29	52	38	44	24	41
52	58	29	33	48	25	28	33	28	70
44	68	30	74	23	28	30	27	15	36
18	35	57	34	33	26	73	53	61	73

- (a) Find the range of the data. [1 mark]
- (b) By using 10 classes and the range in (a) above, determine the class size. [1 mark]
- (c) Complete the following table with 10 classes. Use the smallest value as the lower limit of the first class. [4 marks]

Class Limit	Class Boundary	Frequency	Cumulative frequency

⋮

- (d) (i) Draw a histogram for the data. [9 marks]
- (ii) Is the histogram normal, skewed-left or skewed-right? [1 mark]
- (iii) Estimate the mode from your histogram. [2 marks]
- (iv) Estimate the median. [2 marks]

Question 2 [20 marks]

- (a) A class has 33 students with 20 males. 5 of the males wear glasses. Out of these, 2 are overweight but there are 4 overweight males in total. For the females, 4 wear glasses and out of these, 1 is overweight, and there are 3 overweight females in total. A student is selected randomly. Find the probability that the student
- (i) is a female, [1 mark]
- (ii) does not wear glasses, [1 mark]
- (iii) wears glasses but is not overweight, [2 marks]
- (iv) is not overweight, [1 mark]

Continued...

- (v) is a non-overweight female who does not wear glasses, [3 marks]
(vi) is not overweight or does not wear glasses, [3 marks]
(vii) is a male given that the student does not wear glasses, [2 marks]
- (b) The probabilities that Ali goes to supermarket A and B are 40% and 60% respectively. If he goes to supermarket A , the probabilities that he spends at most 1 hour, or more than 1 hour but does not exceed 2 hours, or more than 2 hours in the supermarket are 20%, 20%, and 60% respectively, whereas for supermarket B , the probabilities are 40%, 40%, and 20% respectively.
- (i) Find the probability that he spends more than 1 hour in a supermarket. [3 marks]
(ii) Find the probability that he spends 1 hour or less in supermarket A . [2 marks]
(iii) Find the probability that he goes to supermarket B given that he spends more than 1 hour in a supermarket. [2 marks]

Question 3 [20 marks]

- (a) A lab has 12 oscilloscopes in which 4 are not working. 2 oscilloscopes are selected randomly. Let X denote the number of oscilloscopes that are not working.
- (i) Draw a tree diagram complete with the leaves for the problem above. Then, construct the probability mass distribution of X in a table. [8 marks]
(ii) Find the mean of X . [2 marks]
- (b) A random variable X has probability density function given by:

$$f(x) = \begin{cases} \frac{1}{3}, & -2 \leq x < 0 \\ \frac{1}{3}(x+k), & 0 \leq x \leq 1 \\ 0, & \text{otherwise} \end{cases}$$

where k is a constant.

- (i) Find the value of k . [3 marks]
(ii) Find the cumulative distribution function $F(x)$. [6 marks]
(iii) Use $F(x)$ to find $P(X < 0)$. [1 mark]

Continued...

Question 4 [20 marks]

- (a) State any two conditions that a Binomial experiment will satisfy. [2 marks]
- (b) A manufacturer produces light bulbs that are packed into boxes of 100, 200, and 500. From the quality control study, a 100-bulb box contains, on average, 0.5 defective light bulbs. The number of defective bulbs follows Poisson probability distribution.
- (i) What is the probability that a 100-bulb box contains no defective light bulbs? [2 marks]
- (ii) What is the probability that a 200-bulb box contains no defective light bulbs? [2 marks]
- (iii) What is the probability that a 500-bulb box contains more than three defective light bulbs? [3 marks]
- (c) In a box of switches, it is known that 8% of the switches are faulty. A technician is wiring 30 circuits, each of which needs one switch.
- (i) What is the probability that all the 30 circuits work? [2 marks]
- (ii) What is the probability that at most 2 of the circuits do not work? [3 marks]
- (iii) Find the variance of the number of working circuits. [2 marks]
- (d) Z is a standard normal random variable. Rewrite the following such that the cumulative standardized normal distribution table provided can be used to find the corresponding probability. No need to find and show any probability value.
- (i) $P(Z > -0.11)$ [1 mark]
- (ii) $P(Z > 1.82)$ [1 mark]
- (iii) $P(-1 < Z < -0.71)$ [1 mark]
- (iv) $P(Z < -2.43)$ [1 mark]

Continued...

Question 5 [20 marks]

(a) Given the population data 5, 5, 6, 6, and 6.

(i) How many samples of size 3 are there? [1 mark]

(ii) Construct the sampling distribution of the sample mean for samples of size 3 by filling in the following two tables. Use subscript to differentiate the same data values, for example, $\bar{x}_1$, $\bar{x}_2$, and $\bar{x}_3$. [8 marks]

No	Sample	Sample mean

⋮

Sample mean	Frequency	Probability of sample mean

⋮

(iii) Sketch the dot plot of the sampling distribution of the sample mean. Is the distribution normal, skewed left, or skewed right? Justify your answer. [4 marks]

(b) The combustion duration of a firework is normally distributed with a mean and standard deviation of 5.2 s and 0.4 s, respectively. Ali takes a sample of 15 fireworks and finds out that the mean combustion duration is 5.5 s, and claims that the population mean is actually greater than 5.2 s. Analyze whether Ali's claim is true.

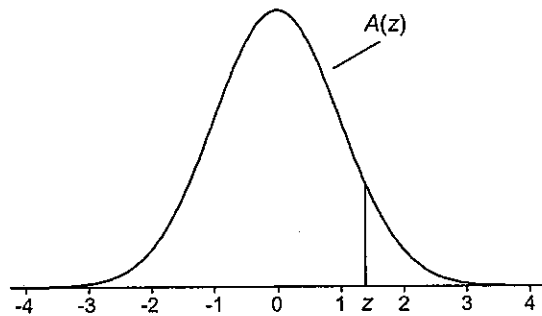
[7 marks]

Continued...

Appendix

TABLE A.1

Cumulative Standardized Normal Distribution



$A(z)$ is the integral of the standardized normal distribution from $-\infty$ to z (in other words, the area under the curve to the left of z). It gives the probability of a normal random variable not being more than z standard deviations above its mean. Values of z of particular importance:

z	$A(z)$	
1.645	0.9500	Lower limit of right 5% tail
1.960	0.9750	Lower limit of right 2.5% tail
2.326	0.9900	Lower limit of right 1% tail
2.576	0.9950	Lower limit of right 0.5% tail
3.090	0.9990	Lower limit of right 0.1% tail
3.291	0.9995	Lower limit of right 0.05% tail

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999							

End of Page

